MULTIFOCAL CONTACT LENS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 08/308,065 filed Sep. 16, 1994 now U.S. Pat. No. 5,619,289, which in turn is a continuation-in-part of application Ser. No. 08/040,422 filed Mar. 31, 1993, now U.S. Pat. No. 5,404,183, application Ser. No. 08/111,845, filed Aug. 25, 1993, now U.S. Pat. No. 5,493,350, and application Ser. No. 08/201,699 filed Feb. 25, 1994, now U.S. Pat. No. 5,526,071. Application Ser. No. 08/111,845 now U.S. Pat. No. 5,493,350, is a continuation-in-part of application Ser. No. 08/040,422, now U.S. Pat. No. 5,404,183, while application Ser. No. 08/201,699 now U.S. Pat. No. 5,526,071, is a continuation-in-part of application Ser. No. 08/040,422 now U.S. Pat. No. 5,404,183, and application Ser. No. 08/111,845 now U.S. Pat. No. 5,493,350.

BACKGROUND OF THE INVENTION

This invention relates to a multifocal contact lens.

Bifocal contact lenses are designed to correct or compensate for a condition of advancing age known as "presbyopia." In a presbyopic eye, the ability to focus at near distances, such as the normal reading distance, and in some cases at intermediate distances, is diminished. The loss of focusing capability is due to hardening of the eye's natural crystalline lens material.

Generally, multifocal contact lenses (usually either bifocal, trifocal or aspheric) are concentric or segmented in configuration. In a conventional bifocal contact lens of the concentric type, a first, centrally located, circular correction zone constitutes either distant or near vision correction, while a second annular correction zone surrounding the first zone provides the corresponding near or distance vision correction, respectively. In a conventional bifocal contact lens of the segmented or translating type, the lens is divided into two somewhat D-shaped zones. Usually the upper area is for distance vision correction, whereas the lower area is for near vision correction. Such conventional segmented contact lenses require some sort of movement of the lens relative to the eye to achieve acceptable visual acuity for both distant and near vision.

One accepted method of fitting contact lenses is based on taking so called K readings (which measure the center of the cornea) and fitting the center of the contact lens in a predetermined relationship to those readings. This, however, is not the only method of fitting contact lenses.

In all conventional bifocal fitting techniques, the bifocal or multifocal contact lenses is optimally designed to be particularly positioned on the cornea. However, it is very difficult in many cases, to position the lens to achieve the required fit. In general, the hardest part of fitting a lens is to position the lens at a desired location on the patient's cornea.

Precise fitting of a bifocal contact lens to the eye is crucial in so called simultaneous vision contact lenses where the brain receives both near and far vision input and selects between the near vision input and the far vision input, depending on the desired object(s) of perception.

As mentioned above, the segmented bifocal contact lenses translate to some extent on the eye. Such lenses cannot be locked onto the cornea. However, for good vision, some stability is necessary.

OBJECTS OF THE INVENTION

An object of the present invention is to provide a multifocal contact lens.

Another particular object of the present invention is to provide such a multifocal contact lens which is made from a polymer material which provides at least about 10% by weight water after hydration.

Yet another object of the present invention is to provide such a lens which has at least one spheric or aspheric posterior surface, or a combination of spheric and aspheric surfaces.

These and other objects of the present invention may be gleaned from the drawings and detailed descriptions set forth herein.

SUMMARY OF THE INVENTION

A multifocal contact lens customized for a patient has, in accordance with the present invention, an anterior side with a power curve defined in part by (i) a central surface, (ii) an inner annular surface contiguous with the central surface, (iii) a second annular surface contiguous along a radially inner periphery with the inner annular surface, and (iv) an outer annular surface contiguous along a radially inner periphery with the second annular surface. Each of the annular surfaces is concentric or coaxial with the central surface. Preferably, the central surface corresponds to a distance vision correction zone, while the inner annular surface corresponds to an intermediate vision correction zone, the second annular surface corresponds to a near vision correction zone, and the outer annular surface corresponds to a distant vision correction zone.

In accordance with another feature of the present invention, at least one of the vision correction zones of the lens is an aspheric zone. In one specific embodiment of the invention, the central zone is an aspheric zone with a standard eccentricity between approximately −0.6 and approximately −1.0, preferably approximately −0.8. One or more of the annular zones may be spheric zones. For example, all of the annular vision correction zones may be spheric. Or, alternatively, the inner annular surface may be aspheric and the second and outer annular surfaces spheric.

According to other features of the present invention, the central surface has a diameter between approximately 1.5 mm and approximately 2.5 mm, the inner annular surface has an outer diameter between approximately 2.0 mm and approximately 3.5 mm, the second annular surface has an outer diameter between approximately 2.3 mm and approximately 4.5 mm, and the outer annular surface has an outer diameter between approximately 3.5 and approximately 8.0 mm. In one specific embodiment of the invention, the central surface has a diameter of approximately 2.2 mm, the inner annular surface has an outer diameter of approximately 2.8 mm, the second annular surface has an outer diameter of approximately 3.5 mm, and the outer annular surface has an outer diameter of approximately 8.0 mm.

The anterior side of the lens may have an annular lenticular area with an inner periphery contiguous with the outer annular surface and with an outer diameter between approximately 8.0 mm and approximately 14.5 mm.

It is contemplated that the multifocal contact lens has a cornea-fitting posterior surface which has an eccentricity magnitude ranging from 0.0 to about 1.5 and including 0.0.

A multifocal contact lens in accordance with the present invention may be manufactured from hydrophilic or soft (hydrogel) polymeric materials i.e., polymeric materials which contain at least about 10% by weight water after hydration, such as disclosed in U.S. Pat. Nos. 5,314,960 and 5,314,961, the disclosure of which is hereby incorporated by reference.